Tinnitus

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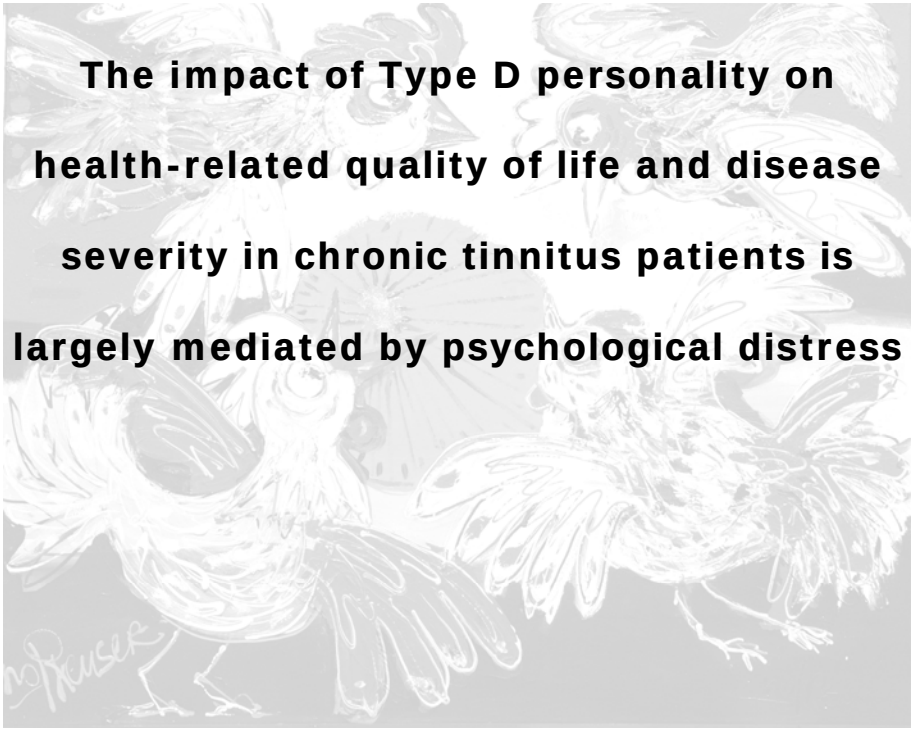
CHAPTER 5



The impact of Type D personality on health-related quality of life and disease severity in chronic tinnitus patients is largely mediated by psychological distress

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Abstract

Objective

To evaluate 1) the predictive power of psychological distress (i.e., vital exhaustion, anxiety and depression) on HRQoL and tinnitus severity, and 2) whether the indicators of psychological distress mediate the impact of Type D personality on HRQoL and disease severity in chronic tinnitus patients.

Material and methods

265 consecutive tinnitus patients completed self-report questionnaires. Anxiety and depression were assessed with the the Hospital Anxiety and Depression Scale, vital exhaustion with the Maastricht Questionnaire, Type D with the DS14, and quality of life with the Short Form Health Survey 36 and tinnitus severity with the Tinnitus Reaction Questionnaire.

Results

Type D tinnitus patients (n=94) did not differ significantly from non-Type D patients (n=171) on sociodemographic characteristics. Type D patients were significantly more anxious, depressed and vitally exhausted, and experienced more impaired HRQoL and increased tinnitus severity compared to non-Type D patients. Structural equation modelling showed that anxiety, depression and vital exhaustion had a direct influence on HRQoL and tinnitus severity, with a higher impact on mental HRQoL (R^2=0.77) compared to physical HRQoL (R^2=0.33). Vital exhaustion was a predictor of HRQoL and tinnitus severity, however, affected by enhanced levels of anxiety and depression. Type D personality directly increased symptoms of depression and anxiety, but not vital exhaustion. Type D was also a direct predictor of poor mental and physical HRQoL and high levels of tinnitus-related distress, although this influence worked mainly via depression and anxiety

Conclusions

All indicators of psychological distress were major predictors of poor HRQoL and tinnitus severity, in which the role of anxiety and depression was more enhanced compared to the role of vital exhaustion. The impact of Type D personality on HRQoL and tinnitus severity was largely mediated by anxiety and depression, although Type D also had a direct effect on these outcomes. Our results underline that for decreasing the implications of having tinnitus on HRQoL and disease-severity, treatment should be mainly directed at reducing anxiety and depression, especially in those patients with a Type D personality.

Introduction

Chronic subjective tinnitus is a common and often disturbing symptom, affecting 10-30% (1-3) of the adult population. About 1-5% of the population is severely affected by their tinnitus perception (2-4). Annoyance ratings and subjective loudness judgments frequently vary over time (5), and a wide variation exists in the impact of tinnitus on every day activities and health-related quality of life (HRQoL). It seems to bother some patients only slightly, whereas the impact on other patients is much more profound, leading to a reduction in daily activities and poor HRQoL (6-11).

Significantly perceived handicap and psychological distress have been described in about 40-50% of tinnitus sufferers (6). This is related to a variety of tinnitus-related complaints: anxiety, depression, insomnia, concentration problems, irritability, anger, frustration, inability to relax, feelings of helplessness, avoidance of noisy or quiet situations, withdrawal from social events, and emotional problems in relationships with family, friends and colleagues (7;11-21). The perceived distress due to tinnitus varies during the day and between days in most patients (22). Frequently a relation exists between the perception of severe tinnitus and the presence of excessive stress or emotions (23-27). Tinnitus noises become troublesome if the patient focuses the attention on the tinnitus (28), with tinnitus-related distress likely being modulated by its uncontrollability and maladaptive coping strategies (24;29-32). The negative impact of anxiety and depression on HRQoL has been described by several authors, using one measure or a combination of generic HRQoL and tinnitus-specific measures for disease severity (6-11;15;18;19;32-43).

Anxiety and depression are generally used as measures of psychological distress,symptomsgenerally being higher in tinnitus patients compared to controls (6-11;15;18;19;32-43). In this study we introduce vital exhaustion as an additional dimension of distress. Moreover, since perceived tinnitus severity was previously described to be associated with symptoms such as insomnia (14;44-46), concentration problems (7;46;47), and relaxation problems (48;49), we hypothesize tinnitus patients to suffer from increased fatigue and irritability. Vital exhaustion is a mental state that is defined as extreme fatigue, increased irritability and demoralization (50). Vital exhaustion has been measured predominantly in patients with cardiovascular disease (CVD) or cancer (51-56). In CVD patients, symptoms of fatigue and vital exhaustion have been described to be more prevalent in patients with a Type D (distressed) personality (57). Type D personality is characterized by negative affectivity and social inhibition. Therefore, Type D patients tend to experience increased negative emotions, generally feel sad and have a gloomy view of life, while not sharing these emotions with others due to fears of how they may react (58). The Type D construct was developed in cardiac patients and has been associated with poor HRQoL, increased levels of distress, less social support, and increased risk of mortality and morbidity in patients with CVD (59-61).

We previously described that tinnitus patients are more likely to have a Type D personality than healthy controls (62). Therefore, it seems likely that tinnitus patients with a Type D personality also experience more distress and poorer HRQoL.

In this study, we evaluated 1) the predictive power of psychological distress (i.e., vital exhaustion, anxiety and depression) on HRQoL and tinnitus severity in tinnitus patients with and without a Type D personality structure, and 2) whether psychological distress mediated the impact of Type D personality on HRQoL and disease severity in chronic tinnitus patients.

Materials and methods

Patients and design

Consecutive chronic subjective tinnitus sufferers (n = 265) seen at the Department of Otorhinolaryngology of the University Medical Center Groningen, the Netherlands, were included in the current study. Tinnitus patients aged ≥ 20 years were included, provided that they were consulting our clinic because of their tinnitus. They were all suffering from chronic tinnitus, defined as a duration of longer than three months. Tinnitus patients were excluded if tinnitus was not the main reason for consulting our clinic, or if they had objective tinnitus (determined by means of a diagnostic protocol for tinnitus) or chronic disease co-morbidity.

Procedure

Psychological distress, HRQoL, tinnitus severity, and Type D personality were measured by means of self-rating questionnaires filled in by the subjects in private. We chose self-rating questionnaires to avoid information bias (e.g. socially desirable responses) that might occur during personal interviews conducted by the otorhinolaryngologist in charge of the subject's medical examination and treatment. We asked subjects to answer the questionnaire at home and, in order to comply with the informed consent condition of protecting the patient's privacy, we also asked subjects to return their sealed questionnaires to the trial centre.

The study protocol was approved by the local medical ethics committee and all patients provided written informed consent.

Measures

Sociodemographic variables

Sociodemographic variables included age, gender, marital status, working status, and educational level.

Anxiety and Depression

The Hospital Anxiety and Depression Scale (HADS)

The HADS was used to assess anxiety and depressive symptoms (63;64). HADS is a 14-item measure, with 7 items contributing to the anxiety and depression subscales,

respectively. All items are answered on a 4-point Likert scale from 0 to 3 (score range of 0-21). The HADS is a reliable questionnaire that performs well in screening for the separate dimensions of anxiety and depression (65).

Vital exhaustion

Maastricht Questionnaire

Vital exhaustion, which is defined as mental fatigue, demoralisation and increased irritability, was assessed by the 21-item Maastricht Questionnaire (MQ) (66). Each item is rated according to a three-point scale (No = 0; ? =1; Yes =2), with a scale score obtained by summing the answers. Thus, the minimum score is 0 and the maximum 42, with a high score indicating a severe level of vital exhaustion. The MQ is an internally consistent measure, with Cronbach's alpha of 0.89.

Generic health-related quality of life (HRQoL)

The Short Form Health Survey 36 (SF-36)

The SF-36 is a valid, reliable, and widely used generic measure of HRQoL that has been used in a myriad of studies of patients with somatic disease and healthy populations, with the 36 items contributing to eight scales: physical functioning, role physical functioning, bodily pain, vitality, social functioning, role emotional functioning, mental health, and general health (67;68). These scales are standardized to a score from 0 (poor) to 100 (high) and can be combined into two component summary scores (i.e., a physical component summary (PCS) and mental component summary (MCS)). The SF-36 has good reliability estimates, with Cronbach's alpha ranging from .65 to .96 for all subscales (69).

Tinnitus Severity

Tinnitus Reaction Questionnaire (TRQ)

The Tinnitus Severity Questionnaire (TRQ), developed by Wilson in 1991 (39), was designed as a measure for distress associated with tinnitus. The TRQ consists of 26 questions that are answered on a 5-point Likert scale from 0 (not at all) to 4 (almost all of the time), with a score range of 0-104. A higher score indicates a higher level of perceived distress caused by tinnitus, also labelled as tinnitus severity. The test-retest reliability (r = .88) and internal consistency (Cronbach's alpha = .96) of the scale are good. A score on the TRQ correlates moderately to highly with clinician ratings (r = .67) and self-report measures of anxiety and depression (r = .58-.87) (39).

Type D (distressed) personality

DS14

Type D personality was assessed with the 14-item Type-D Scale (DS14) (58). The DS14 consists of the subscales negative affectivity (NA: 7 items; e.g., "I often feel unhappy") and social inhibition (SI: 7 items; e.g., "I am a 'closed' person"). Type D personality characterizes those who tend to experience increased negative emotions and who do not express these emotions in social interactions. A cut-off score ≥10 on

both subscales denotes those with a Type D personality (70). The DS14 has adequate reliability, with Cronbach's alpha = 0.89 / 0.88 and 3-months test-retest reliability of $r = 0.72 / 0.82$ for the NA and the SI subscales, respectively (58).

Statistical analyses

Bivariate analyses

Discrete variables were compared using the chi-square test (Fisher's exact test when appropriate and the difference of proportions test (71)), and are presented as numbers and percentages. Continuous variables were normally distributed (Shapiro Wilk, $p > 0.05$), and were therefore compared with the Student t-test for independent samples and are presented as means ± SD. Effect sizes (ES) were calculated only for the statistically significant results, since differences between groups that are due to random variation have no clinical relevance. Cohen's ES "d" for unrelated samples was used to estimate the magnitude of the difference between two groups (mean difference score/the pooled standard deviation). According to Cohen's thresholds, an ES of < 0.20 indicates a trivial difference, an ES of ≥ 0.20 to < 0.50 a small difference, an ES of ≥ 0.50 to < 0.80 a moderate difference and ES ≥ 0.80 a large difference (72). Middel et al. showed that ES ≥ 0.20 reflects a clinically relevant difference (73) which was confirmed by Samsa et al. (74). Therefore, in this study an ES ≥ 0.20 was considered to be a clinically relevant difference between Type D and non-Type D tinnitus patients. All statistical tests were two-tailed. A value of $p < 0.05$ was used for all tests to indicate statistical significance. All statistical analyses were performed using SPSS 13.0.1 for Windows.

Structural Equation Model (SEM)

A hypothesized model was investigated with structural equation modeling (SEM). SEM is a multivariable technique for testing the tenability of this model and is an elaboration of regression analysis. Path analysis was used to test a hypothesized model in which: (i) increased psychological distress (i.e., enhanced levels of depression, anxiety, and vital exhaustion) are predictors of poor mental and physical HRQoL and tinnitus severity, and (ii) Type D personality influences directly and indirectly mental and physical HRQoL and tinnitus severity through its effect on the indicators of psychological distress (i.e., anxiety, depression, and vital exhaustion). The latent construct Type D personality was estimated with the indicators of negative affectivity (NA) and social inhibition (SI), and defined as simultaneously high scores on both subscales (58). To allow for mutual comparisons between the path coefficients, the completely standardized solution was used. For judging the model fit, we used multiple criteria as suggested by Bentler and Bonett (75). The fit of the model was evaluated by means of (a) non-significant χ^2 indicating that a non-significant amount of variance in the data remains unexplained; a ratio of χ^2 to the degrees of freedom less than three generally indicates a good model fit (76); (b) the root mean square error of approximation (RMSEA) (77); (c) the standardized root mean square residual (SRMR) (78-80); (d) the comparative fit index (CFI)(81); and (e) the Adjusted Goodness of Fit Index (AGFI)(80). Both CFI and RMSEA were

used, as it has been argued that they provide more stable and accurate estimates than several of the other fit indices (81;82). Structural paths with related t-values > 1.96 can be regarded as significant at $p<0.05$ (i.e., parameter estimates ±1.96 standard errors should exclude 0). Given their complementary features, we used all five indices compared against their critical values to evaluate the models.

Results

Baseline characteristics stratified by Type D personality

Type D tinnitus patients (n=94) did not differ significantly from non-Type D tinnitus patients (n=171) on sociodemographic characteristics (Table 1).

Table 1. Sociodemographic characteristics of tinnitus patients stratified by Type D personality*

	Type D n= 94	**Non-Type D n= 171**	**P-value**	
Age (years)				
< 50 years	62 (66.0)	99 (57.9)	0.24[2]	
mean (SD)	55.68 (10.67)	55.77 (11.70)	0.95[1]	
Males	69 (73.4)	116 (67.8)	0.41[2]	
Married/living with partner	81 (86.2)	153 (89.5)	0.43[2]	
Working	41 (43.6)	96 (56.8)	0.06[2]	
Educational level			**95% CI**	
elementary schooling	13 (15.1)	30 (18.6)	- 6.1	13.2[3]
lower schooling	20 (23.3)	31 (19.3)	- 14.8	6.8[3]
secondary schooling	21 (24.4)	43 (26.7)	- 9.1	13.7[3]
higher professional training	25 (29.1)	43 (26.7)	-14.1	9.4[3]
college education/university	7 (8.1)	14 (8.7)	- 6.7	7.8[3]

* Results are presented as n (%) unless otherwise indicated

1. Student's T-test
2. Fisher exact test
3. Difference of proportions test

Differences in distress and health-related quality of life between Type D and non-Type D tinnitus patients

Means, standard deviations, p-values and effect sizes for the different measures of psychological distress and HRQoL are shown in Table 2 . Type D tinnitus patients reported more anxiety, more depressive symptoms, more symptoms of vital exhaustion, and poorer HRQoL compared to non-Type D tinnitus patients. All differences in psychological distress and HRQoL outcomes were statistically significant ($p < 0.001$) and clinically relevant, as indicated by a large ES (≥ .80)

according to Cohen's effect size index. Nevertheless, the effect size of the difference in physical HRQoL between Type D and non-Type D patients was moderate (ES = 0.61) (Table 2).

Table 2. Differences in psychological distress and health-related quality of life stratified by Type D personality

	Type D (n = 94)		**Non- Type D** (n = 171)		p-value[1]	Effect Size (ES)	95% CI for ES	
	mean	SD	mean	SD			lower	Upper
psychological distress								
Anxiety	10.99	3.97	6.37	4.27	.0001	1.11	0.83	1.37
Depression	10.25	3.99	5.70	4.57	.0001	1.04	0.77	1.30
vital exhaustion	33.77	7.88	20.76	11.88	.0001	1.22	0.95	1.49
health-related QoL								
mental HRQoL	41.49	19.44	66.20	22.58	.0001	1.15	0.88	1.42
physical HRQoL	56.43	18.49	66.99	16.54	.0001	0.61	0.35	0.87
tinnitus severity	63.40	15.46	42.59	21.94	.0001	1.05	0.78	1.31

1. T-test

The relationship between Type D personality, psychological distress, health-related quality of life, and tinnitus severity (LISREL models)

All models were evaluated by examining the parameter estimates and by the indices of overall fit provided by LISREL. Residual correlations between NA and SI, between anxiety and depression were allowed as they belonged to the same measure and were assessed simultaneously. All model parameters met the criteria of good model fit as presented in Table 3. For each model, the Chi-square statistic indicated that a non-significant amount of variance in the data remained unexplained and relative to degrees of freedom was less than two, suggesting a good initial indicator of fit. The RMSEA was sufficiently low (<0.06), as was the SRMR (<0.005). The CFI value of 1.00 exceeded the .97 value and the AGFI index was > .95. Taken together, these results suggest that the hypothesized models fitted the data well.

Table 3. Parameters of model fit for mental, physical health-related quality of Life and tinnitus severity

Critical values of parameter estimates	χ^2	df	P	RMSEA <0.06	AGFI >0.95	SRMR <0.05	CFI# >0.97	R^2
parameter estimates								
Mental HRQoL (SF-36)	5.09	3	0.17	0.051	0.96	0.014	1.00	74
Physical HRQoL (SF-36)	5.82	3	0.12	0.06	0.95	0.019	1.00	33
Disease severity (TRQ)	5.96	3	0.11	0.56	0.95	0.001	1.00	65

the comparative fit index (CFI) with a value > .97 indicates a good fit. According to Hu and Bentler (1999), this criterion is more appropriate than the >.95 criterion, as the large number of severely misspecified models is unacceptable (81)

Figures 1-3 show the results of the path analysis, depicted by the direct and mediated paths between Type D personality, anxiety, depression and vital exhaustion, and the outcomes HRQoL and tinnitus severity, respectively. HRQoL is differentiated into components of mental and physical HRQoL.

Overall, as hypothesized in our model within our tinnitus population, the more anxious, depressed or vitally exhausted patients were, the poorer the perception of global mental HRQoL (β= -.30, β= -.30 and β= -.29, respectively) and physical HRQoL (β= -.28, β= -.34 and β= -.45, respectively), and the more increased tinnitus severity (β= .21, β= .25 and β= .19, respectively), These parameter estimates were significant (with negative betas for HRQoL and positive beta for TRQ), indicating that increased symptoms of anxiety, depression and vital exhaustion led to reduced mental and physical HRQoL and increased tinnitus severity. According to our hypothesis, Type D personality was associated with increased symptoms of anxiety, depression and vital exhaustion, and poorer HRQoL and increased tinnitus severity. Presented figures mainly demonstrated the mediating role of the three indicators of psychological distress on the impact of Type D on HRQoL and disease severity.

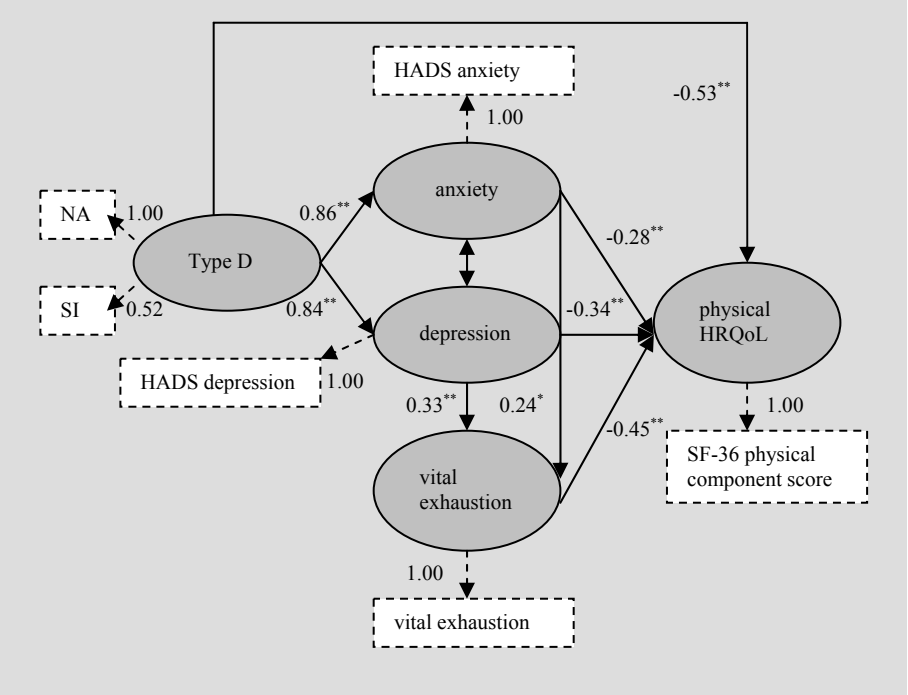

Figure 1. *A path model of Type D personality as predictor of anxiety and depression as precursors of poor physical HRQoL in tinnitus patients. Coefficients are all statistically significant, *<0.05, **<0.01*

Figure 1: Physical HRQoL (R^2 =0.33)
Anxiety, depression and vital exhaustion all turned out to predict physical HRQoL in the tinnitus population (β=-.28, -.34, -.45 respectively). Type D personality significantly influenced anxiety, depression and physical HRQoL (β=-,86 β=.84, β=.53 respectively), but Type D did not directly influence vital exhaustion. However, the path analyses showed that the influence of Type D on vital exhaustion was present via anxiety (β=0.24) and depression (β=0.33). Overall, perceived physical HRQoL in the tinnitus population was predominantly determined by anxiety and depression, but also by Type D personality both by itself and via anxiety and depression.

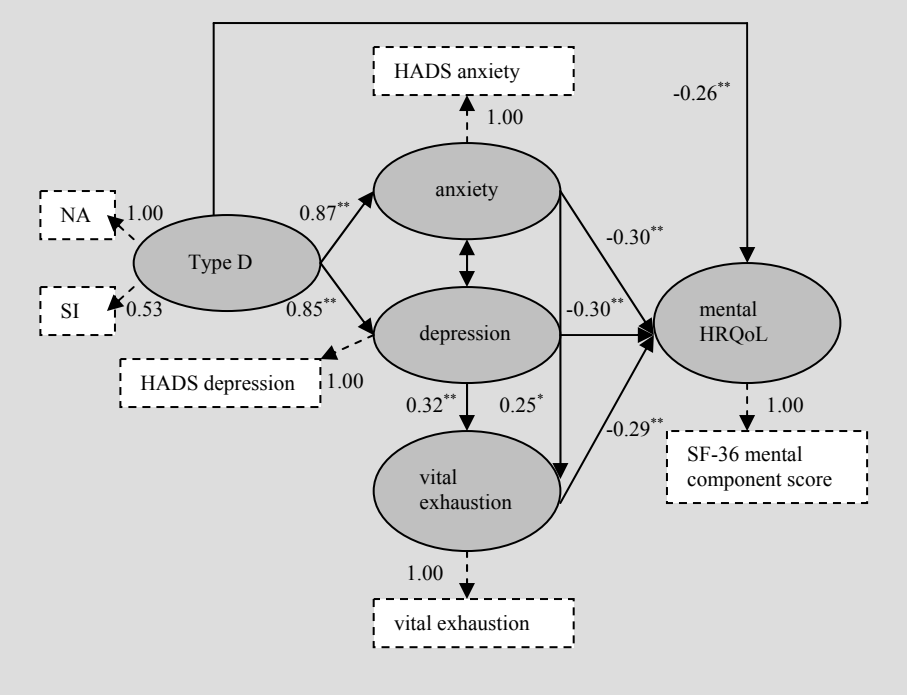

Figure 2. *A path model of Type D personality as predictor of anxiety and depression as precursors of poor mental HRQoL in tinnitus patients. Coefficients are all statistically significant, *<0.05, **<0.01*

Figure 2: Mental HRQoL (R^2 =0.74)
This model shows that all indicators of psychological distress predict mental HRQoL in the tinnitus population at a level comparable to that of physical HRQoL (β=-0.30, -0.30, -0.29). Type D directly elevated anxiety (β=0.87) and depression (β=0.85) and decreased mental HRQoL (β=-.26), but did not increase vital exhaustion. The influence of Type D personality on vital exhaustion was only induced via anxiety (β=0.25) and depression (β=0.32).

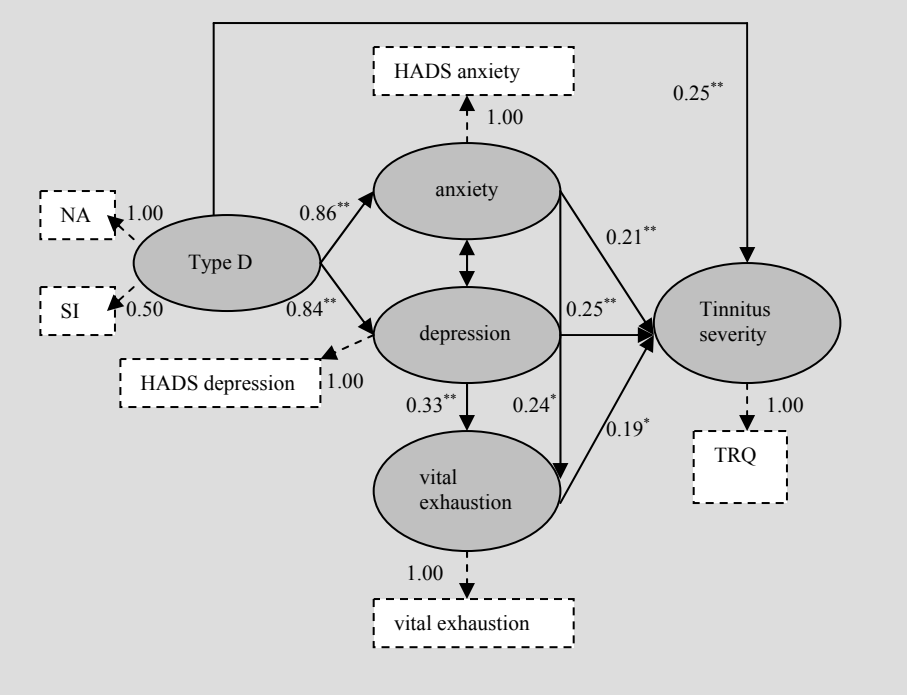

Figure 3. *A path model of Type D personality as predictor of anxiety and depression as precursors of increased disease severity in tinnitus patients. Coefficients are all statistically significant, *<0.05, **<0.01*

Figure 3: Tinnitus severity: (R^2 =0.69)
All direct paths from anxiety, depression and vital exhaustion exerted an effect on tinnitus severity. These parameter estimates were significant with positive betas indicating that more symptoms of anxiety, depression and vital exhaustion led to an increase in tinnitus severity (β= 0.21, β= 0.25 and β= 0.19, respectively). Type D directly influenced anxiety (β=0.86), depression (β=0.84), and tinnitus severity (β=0.25), but no significant pathways were found between Type D and vital exhaustion. Type D mediated vital exhaustion via anxiety (β=.24) and depression (β= .33).

Predicting and mediating role of Type D across all models
Type D exerted a direct effect on anxiety, depression, mental and physical HRQoL, and tinnitus severity. Type D personality had a higher direct effect on physical HRQoL (β= -.53, Figure 1) than on mental HRQoL (β= -.26, Figure 2) and tinnitus severity (β=.25, Figure 3). Furthermore, Type D personality had a considerable direct effect on both anxiety and depression across all models, but did not have a direct effect on vital exhaustion in any of the models. According to all presented

figures, psychological distress (mainly anxiety and depression) mediated the relationship between Type D and HRQoL / tinnitus severity. Type D personality, anxiety and depression explained 55% of the variance in mental HRQoL and 31% of the variance in physical HRQoL and 65 % of the variance in tinnitus severity.

Discussion

In this study of a tinnitus population, we found statistically significant and clinically relevant differences in all measures of psychological distress (i.e., anxiety, depression, and vital exhaustion), HRQoL and disease severity between Type D versus non-Type D patients. The two personality types were comparable on sociodemographic characteristics. Since we were interested in the relative influence of the different indicators of psychological distress on mental and physical HRQoL and tinnitus severity, we performed path analyses by means of structural equation modeling (SEM) using LISREL . Anxiety and depression were direct major predictors of mental and physical HRQoL and tinnitus severity in the tinnitus population, but also indirect via enhancing vital exhaustion. Type D was a direct predictor of mental and physical HRQoL and tinnitus severity, but the impact of Type D on HRQoL and tinnitus severity was mainly mediated by anxiety and depression. Via strong influences on anxiety and depression, Type D only indirectly influenced vital exhaustion. These results provide evidence that increased levels of anxiety and depression are precursors of reduced mental and physical HRQoL and increased tinnitus severity, and that these indicators of psychological distress mediate the impact of Type D personality on HRQoL and disease severity in tinnitus patients.

In accordance to expectations, the presented LISREL-models showed that the explained variance in mental HRQoL was larger than for physical HRQoL. This indicates that psychological distress has a larger impact on mental HRQoL than on physical HRQoL in tinnitus patients. Although Type D was shown to exert a direct effect on mental and physical HRQoL and tinnitus severity, the majority of the effect of Type D on HRQoL and tinnitus severity was induced via the indicators of distress, and predominantly anxiety and depression. Since there is a large overlap between anxiety, depression, and mental HRQoL, this might explain the lower regression coefficient between Type D and mental HRQoL, with most of the variance following a pathway via anxiety and depression.

Psychological distress has been described to be the most important predictor of impaired HRQoL in chronic diseases in general (83-85). The term ‘psychological distress’ may accurately describe the individualized, subjective patient response to acute or chronic illness (83;85-93). If individuals experience psychological distress it may be manifested by an alteration from a stable baseline emotional state to one of anxiety, depression, demotivation, vital exhaustion, irritability, aggressiveness, self-depreciation, and even suicide in the extreme (50;84;90;94). Several tinnitus studies have reported that anxiety and depression are

important indicators of poor HRQoL contributing to the development of severe annoying tinnitus (11;14-18;24-27;31;36;95). Since vital exhaustion has previously been shown to be associated with psychological distress and poor HRQoL in patients with CVD (96-99), we decided to examine the role of vital exhaustion in tinnitus patients. Vital exhaustion was never previously investigated in tinnitus patients. Vital exhaustion was shown to directly predict both mental and physical HRQoL and tinnitus severity in tinnitus patients, and to exert an indirect effect on HRQoL via anxiety and depression. Our study demonstrated that the addition of vital exhaustion as an indicator for psychological distress may be worthwhile in the study of tinnitus patients.

The relation between Type D personality and different indicators of psychological distress is in accordance with previously performed studies in CVD patients (99;100). Our results demonstrated that Type D personality mainly influences anxiety and depression, and thereby indirectly vital exhaustion, HRQoL and tinnitus severity. This extends research on Type D personality, showing that the impact of Type D personality on HRQoL and disease severity is mainly mediated by psychological distress. In turn, this provides important information for both research and clinical practice, showing that tinnitus patients with a Type D personality are particularly prone to distress and therefore poor HRQoL and more tinnitus severity. Hence, in order to improve the HRQoL of tinnitus patients, interventions in these patients should be targeted towards reducing psychological distress, in particular in Type D patients.

In conclusion, we found that Type D tinnitus patients experienced more psychological distress and poorer HRQoL than non-Type D tinnitus patients. Anxiety, depression and vital exhaustion were direct predictors of all measures of HRQoL and disease severity in the tinnitus population. Although Type D was a direct predictor of mental and physical HRQoL and tinnitus severity, the impact of Type D on HRQoL and tinnitus severity was mainly mediated via anxiety and depression. These results provide evidence that increased levels of anxiety and depression are precursors of poor HRQoL and increased tinnitus severity, but that personality also plays an important role with its impact on HRQoL and disease severity being mediated by psychological distress. From a clinical point of view, these results underline that in order to improve HRQoL and decrease tinnitus severity in tinnitus patients, treatment and psychosocial interventions should be mainly directed at reducing anxiety and depression, especially in those patients with a Type D personality.

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